intermediaries. Here, however, is a chain of two links, obviating the necessity of the "middle man," and five words tell a complete story: "No diatoms, no gizzard shad." In some fishes from Ohio another story is told by changing diatoms to *Pediastrum;* still another, if one puts in *Scenedesmus;* for most of the young fishes examined the complete story reads: "No phytoplankton, no gizzard shad."

4. Flagellate forms, species of *Euglena* and *Phacus* in particular, are less common in the Ohio fishes.

5. The relative abundance of the different forms of the phytoplankton of the bodies of water is revealed by the algal content of the gizzard shad found there.

6. In general, algal species belonging to the order *Protococcales* form more commonly a larger portion of the food of the gizzard shad than do either flagellates or diatoms. Sometimes, however, the condition is reversed; but this is apparently purely a matter of the plankton content of the water.

7. The fewness of the zooplankton forms is somewhat less marked in the specimens from Illinois than in those from Ohio. This may again be due to the predominance of the phytoplankton over the zooplankton in the localities where the fish were obtained.

8. The paucity of stream phytoplankton in comparison with that of ponds and lakes is shown by the relative algal content of the digestive tract of the gizzard shad taken from running and quiet waters. The excessive diatom content of stream water at certain periods—producing the so-called "pulses" of Kofoid[3]—when there is a marked rise in temperature is only temporary and may be explained, as Professor Transeau suggests, by the rapid dissolving of the mucus and a consequent breaking up of the chains and colonies of diatoms. This usually takes place in the small tributaries where the individual diatoms are thus freed from their places of attachment; and the main stream is merely the recipient of the contribution, not the source of the sudden "pulse."

9. There is a continuation of the above story in which the gizzard shad plays an important rôle: it feeds the game fishes, and the game fishes feed man. Thus, the gizzard shad is making useful for man the energy stored in plant forms which occupy no land areas, which do not interfere with the ordinary disposition or utilization of bodies of water (except the occasional contamination of water for drinking purposes by some algæ), which involve no labor of cultivation on the part of man, and which are of no value for direct human consumption.

10. The world's population in the last hundred years has increased about 150 per cent. Along with this increase has had to come a corresponding increase in the world's food supply. One of the ways in which this necessity has been met is the securing of new acres of soil in which to grow crops. It is easily seen, however, that there is a limit to new acreage. In the future, therefore, we may have to turn more of our attention to the cultivation of the waters for food supplies. We may have to develop an industry of aquiculture as we have developed an industry of agriculture. The time is rapidly approaching when fish will be more highly prized as food and more extensively used than now. As that time comes, the cultivation of algæ will be a first step toward greater fish production. A second step may be the introduction of fish like the gizzard shad into fish ponds and lakes to make more readily available the phytoplankton for fish food.

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[3] *Bulletin of the Illinois State Laboratory of Natural History,* 6, pp. 226, 569, 571, 1903.

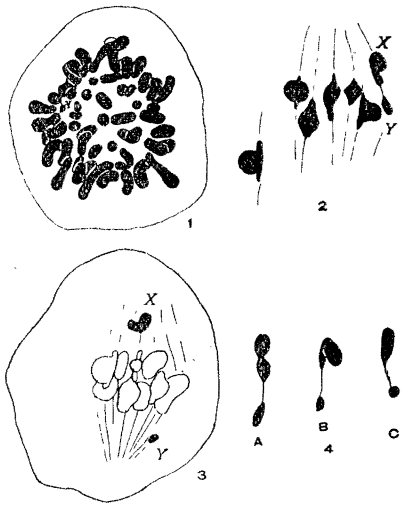
THE SEX CHROMOSOMES OF THE MONKEY[1]

PREVIOUS studies on the spermatogenesis of the opossum ('22) and on man (in press) have

[1] Contribution No. 159, Department of Zoology, University of Texas. The present work has been aided by a grant from the National Research Council—Committee for Research on Sex Problems. In view of the crowded condition of our journals which greatly delays publication, the author is presenting in this brief way the essential facts of general interest to biologists. The completed study will give the detailed evidence. Painter, T. S.: 1922, "The Spermatogenesis of the Opossum," *Journ. Exp. Zool., Vol.* 35.

shown that both of these mammals possess the X-Y type of sex chromosome. The spermatogenesis of the "ring-tail" monkey (exact species not yet determined) shows essentially the same conditions as were found in the opossum and in man.

In dividing spermatogonia (fig. 1) one counts 54 chromosomes. It is to be noted that the smallest element has no mate of like size and shape. It is the "male determining," or "Y" chromosome.



During the first maturation division one finds among the tetrads an element the two components of which are very unequal in size (fig. 2). This is the X-Y sex chromosome complex. The X and the Y components go undivided to opposite poles of the cell, so that the secondary spermatocytes have either an X or a Y chromosome. In the second maturation division the sex chromosome (either X or Y) divides equationally. 27 chromosomes have been counted in the late telophase of the second maturation division. (In figs. 2 and 3 only part of the tetrads are shown).

In figure 4 the sex chromosomes—as seen in the first maturation division—are given for A opossum, B monkey, C man. It is interesting to note that recent work on the genetics of man (Schoenfield—See Castle, SCIENCE, Vol. 55, p. 703) confirms the results of my cytological studies.

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A SIMPLE GAS GENERATOR FOR LABORATORY USE

IT is frequently necessary to prepare small quantities of carbon dioxide, hydrogen, hydrogen sulfide, chlorine, hydrochloric acid gas, oxygen, etc., in the general laboratory work and in many laboratories it is not practicable nor desirable to maintain a lot of elaborate equipment for the generation of these various gases, especially for the small quantities intermittently needed.

To prepare a special flask each time occasion arises to generate a gas is at least bothersome and time consuming and involves a waste of reagents. On the other hand, a simple piece of apparatus, taking no more room on the shelf than a reagent bottle, adaptable to the preparation of any of several gases at a moment's notice without waste of reagent, commends itself.

The apparatus here presented developed from such a need and can be easily prepared out of ordinary laboratory equipment; a large wide-mouthed bottle, two test tubes, two cocks, rubber stoppers and glass tubing are all that is required.

An examination of the diagram will show the simplicity and convenience of construction and operation.

CONSTRUCTION

Into the wide mouthed bottle *A* is fitted a large rubber stopper *D-D* containing one small hole for the tube *H* terminating in stopcock *N*, and a large hole for the large test tube B. At

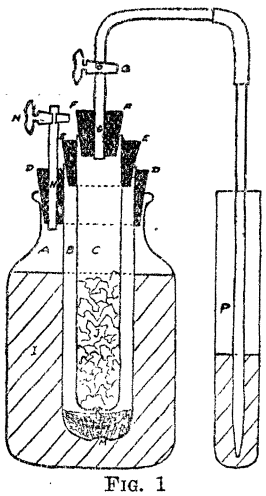

FIG. 1